Virtual Proving Ground Transforms Test and Evaluation

Michael Cast

The war in Iraq underscores the urgent need for U.S. forces that are rapidly deployable, able to operate in urban areas and rural terrain, are light but lethal and prepared to conduct a full spectrum of operations — from combat to humanitarian aid. Former Army Chief of Staff GEN Eric K. Shinseki emphasized these requirements when he officially announced plans to transform the Army at the Association of the United States Army's October 1999 annual conference.

The Army Test and Evaluation Command (ATEC), headquartered in Alexandria, VA, and its subordinate organizations, are working together to pinpoint the inevitable technical problems with developmental systems and ensure the Army fields systems that meet rigorous performance standards. At Aberdeen Proving Ground (APG), MD, the Army Developmental Test Command (DTC), its Aberdeen Test Center (ATC) and Army Evaluation Center elements are working beyond normal duty hours to meet this challenge, as is the Operational Test Command at Fort Hood, TX.

Development of Interim and Future Systems

As the Army modifies its force configurations, doctrine, training, logistics and military hardware, it must acquire existing and even futuristic warfighting systems, some of which pose a real challenge to human ingenuity. Army scientists and engineers, in partnership with defense contractors, are tackling the technical difficulties and are using commercially available "off-the-shelf" sources already under development by defense contractors.

As the century began, the Army was building an "interim force" to meet its near-term military objectives, which meant establishing, equipping and training rapid-reaction brigade combat teams at Fort Lewis, WA. In May 2000, the Army program manager responsible for equipping the brigades had commercial contractors bring a variety of wheeled and tracked armored vehicles to ATC for an evaluation. Based on several performance criteria, the Army's source-selection board chose the Light Armored Vehicle III, an 8-wheeled armored vehicle manufactured in Canada, as the basis for the Army's new Stryker interim armored vehicle. Stryker variants and configurations, the Brigade Combat Team's operational mainstay, have undergone rigorous trials at DTC sites throughout the United States.

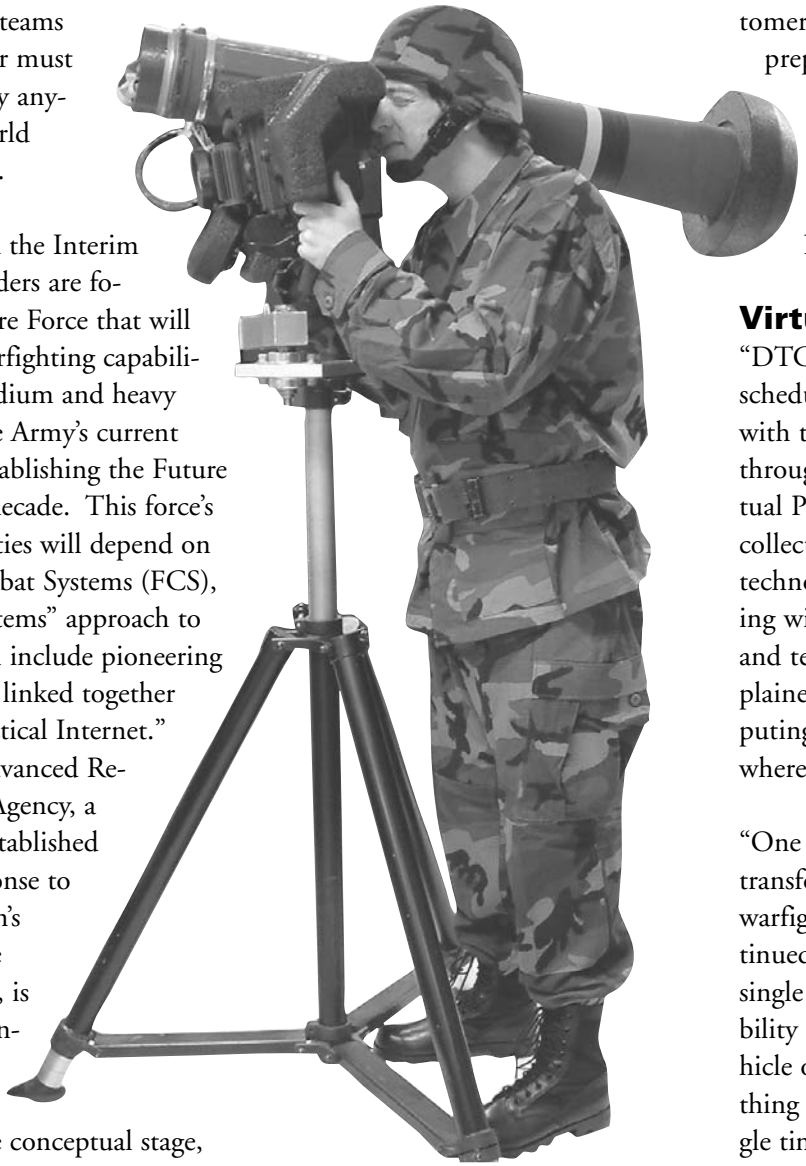
Test results confirm that the Stryker can move faster than tracked vehicles, consumes less fuel, requires a smaller logistic support

base and is designed to cover the terrain that is becoming the Army's new battlefield. Its light weight, when compared to the 70-ton Abrams main battle tank, also makes it suitable for transport by C-130 cargo aircraft, which can land on dirt airstrips. The Army views this capability as a "key performance parameter" because brigade combat teams using the Stryker must be able to deploy anywhere in the world within 96 hours.

Looking beyond the Interim Force, Army leaders are focused on a Future Force that will combine the warfighting capabilities of light, medium and heavy Army units. The Army's current plans call for establishing the Future Force within a decade. This force's combat capabilities will depend on the Future Combat Systems (FCS), a "system-of-systems" approach to combat that will include pioneering weapon systems linked together through the "tactical Internet." The Defense Advanced Research Projects Agency, a DOD agency established in 1958 in response to the Soviet Union's launching of the Sputnik satellite, is the research sponsor for FCS. Much of FCS is still just at the conceptual stage, but scientists, researchers and industry giants such as Boeing are collaborating closely to make it a reality. The Army's current goal is to equip the first Future Force unit with FCS for initial operational capability by the end of calendar year 2010.

Transformation of Test and Evaluation

FCS concepts include robotic reconnaissance vehicles and sensors, a weapons platform that will perform the function of a main battle tank, networked fires from various ground and air weapons platforms and advanced 3-D targeting systems that operate on land and in the air. Systems reliability will depend heavily on state-of-the-art hardware and software technologies and the correspondingly sophisticated technologies needed to test them realistically.



To meet this challenge head on, said Dr. C. David Brown, Test and Evaluation Director for FCS, "The Army is developing innovative test and evaluation capabilities hand-in-hand with the Army's current transformation. DTC is continually striving to improve its test technologies so it can capture the best data possible for test customers and Army evaluators who prepare system evaluation reports to help military and civilian officials decide whether to field, modify or cancel new or upgraded systems," Brown continued.

Virtual Proving Ground

"DTC is striving to streamline test schedules, cut costs and keep pace with the Army's transformation through initiatives such as the Virtual Proving Ground (VPG), the collective term for DTC test center technologies that integrate live testing with computer-aided modeling and test simulation," Brown explained. "High-performance computing capabilities at APG and elsewhere make the VPG possible."

"One of the integral parts of Army transformation is a distributed warfighting capability," Brown continued. "FCS is not going to be a single system where all of its capability is integrated into a single vehicle or item. You can't get everything at a single test center at a single time, so we have to be able to link together multiple test centers and multiple capabilities across the country — to include contractor capabilities, traditional operational test sites and our technical test sites, typically our ranges — all at once. We have to be able to stimulate

some sort of scenario across them, and that's where VPG comes in."

"But we also have to be able to collect data and save time, in a distributed fashion," Brown reiterated. "That means we must have smart sensors and instrumentation systems on these various pieces of a system, and we need to be able to reconfigure and control them from afar, because no longer will the tester, the people interested in data, data collectors or anyone else in the chain be with the system. They could be thousands of miles away."

"They also need to be able to query instrumentation and get the data," Brown continued. "The data have to be sent right off the system as rapidly as possible, or almost instantly get into some sort of what we call 'wire-neutral' communication system, via satellite links, cellular links or high-speed data links. That's where the Virtual Information System, Integrated ONline comes in."

Virtual Information System, Integrated ONline

This test and evaluation support program — known as VISION for short — is a system developed at ATC that uses state-of-the-art data-collection technologies, a digital data library accessible to test customers and other authorized users via the Internet and a full range of communications technologies to link it to remote test sites. VISION is designed to provide quick access to information about testing, enabling test customers to make decisions affecting a system's acquisition sooner than was possible in the past. Brown noted that VISION provided data that helped the source-selection board decide on the type of vehicle that would become the Stryker, and it has continued to support Stryker testing as well as a variety of other tests across ATEC and DTC.

"The VISION system was developed primarily to capture and share test data on vehicles such as trucks, Humvees and tanks because ATC is the Army's primary developmental tester for these types of systems," said Dr. Samuel Harley, an ATC scientist who was instrumental in developing the program. "But VISION can also be configured for use on missiles, aircraft and other types of systems under test to support the full spectrum of testing conducted by DTC," Harley added.

Intelligent Instruments

VISION employs a variety of "intelligent" instruments known as the Advanced Distributed Modular Acquisition Systems, developed by the team at ATC for collecting such diverse test data as engine fluid temperatures, power output, engine speed, shock and vibration, stresses and strains on gears and equipment, gun accuracy and other types of data that can be used to pinpoint problems and support evaluations. "These collection devices are made small enough in size, large enough in processing power, low enough in power consumption and robust enough to function for extended periods in any harsh environment in which the military might operate," Harley explained.

"They share a common device architecture, making it relatively easy to add new devices as new requirements surface," he continued.

"Some Army officials want to embed ruggedized data-collection devices into equipment when it is manufactured to get diagnostic information from the developmental phase through operational testing to actual use in combat."

ATC is using the VISION program to continue its development of data-collection instrumentation and working to integrate developmental and operational testing. "On Stryker testing, we're approaching this from a common instrumentation suite," Harley noted. "The Stryker is really the first weapon system that does use the entire suite of capabilities. We will use the same instrumentation for developmental and operational testing."

VISION is a work in progress as the ATC team continually strives to improve its ease of use and usefulness to testers, test evaluators and customers. "We've got a plan laid out and are going through a spiral development effort so that we keep adding capabilities as time goes on," Harley said. "That will be complete in another 5 or 6 years. There are some complementary efforts going on at other test centers. We would like to see cooperative efforts on this front increase," he concluded.

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